CLAIMS

1. A method of assaying an analyte in a body part comprising:

illuminating the body part with at least one pulse of light at each of first and second wavelengths that stimulates photoacoustic waves in a first, target, region and a second, reference, region of the body part, wherein the reference region interfaces with the target region and has at least one known optoacoustic property and wherein light at the first wavelength is absorbed and/or scattered by the analyte;

sensing pressure in the photoacoustic waves from the target and reference regions stimulated by the light at the first and second wavelengths; and

using the sensed pressures and the at least one known optoacoustic property to assay the analyte in the target region

2. A method according to claim 1 wherein the reference region is a natural region of the body part.

3. A method according to claim 1 wherein the reference region is an artificial implant located in the body part.

4. A method according to claim 2 or claim 3 wherein using the sensed pressures comprises determining a concentration of the analyte in accordance with a function dependent on the known property and having dependence on the pressures only through ratios of pressures.

5. A method according to claim 4 wherein dependence on ratios comprises dependence on a ratio between pressure of photoacoustic waves stimulated by light at the first wavelength and pressure of photoacoustic waves stimulated by light at the second wavelength in a same region.

6. A method according to claim 4 or claim 5 wherein dependence on only ratios comprises dependence on a ratio between pressure of photoacoustic waves stimulated by light at the first wavelength in one of the target and reference regions and pressure of photoacoustic

waves stimulated by light at the second wavelength in a different one of the target and reference regions.

7. A method according to any of claims 4-6 wherein sensing pressures comprises sensing pressures from photoacoustic on opposite sides of the interface sufficiently close to the interface so that a ratio of intensity of light at the first wavelength to intensity of light at the second wavelength in the target region is substantially equal to a ratio of intensity of light at the first wavelength to intensity of light at the second wavelength in the reference region.

8. A method according to any of claims 4-7 and comprising acquiring a value for the at least one optoacoustic property responsive to a calibration procedure comprising:

acquiring at least one assay of the analyte in accordance with a method that is independent of the function; and

determining a value for the known property by requiring that for each assay acquired by the independent method an assay determined in accordance with the function be substantially equal to the acquired assay.

9. A method according to any of claims 1-8 wherein the at least one optoacoustic property comprises a ratio between the absorption coefficients for light in the implant at the first and second wavelengths.

10. A method according to any of claims 1-9 and comprising choosing the first and second wavelengths so that at the interface between the target region and the reference region reflectance of light at the wavelengths is substantially the same.

11. A method according to claim 10 wherein choosing the wavelengths comprises choosing the wavelength sufficiently close to each other so that the reflectance is substantially the same.

12. A method according to claim 3 wherein the implant is a layered body comprising a plurality of contiguous layers.

13. A method according to claim 12 wherein the implant comprises two layers, a first and second contiguous layers, which first layer interfaces with the target region.

14. A method according to claim 13 wherein the first layer is substantially transparent to light at the first and second wavelengths.

15. A method according to claim 14 wherein the second layer absorbs light at the first and second wavelengths.

16. A method according to 15 and comprising choosing the first and second wavelengths so that reflectance at the interface between the target region and the first layer is substantially the same for light at the first and second wavelengths.

17. A method according to claim 16 and comprising choosing the first and second wavelengths so that reflectance at the interface between the first and second layers is substantially the same for light at the first and second wavelengths.

18. A method according to claim 17 wherein choosing the wavelengths comprises choosing the wavelength sufficiently close to each other so that the reflectance is substantially the same.

19. A method according to any of claims 12-18 wherein using the sensed pressures comprises determining a concentration of the analyte in accordance with a function dependent on the known property and having dependence on the pressures only through ratios of the pressures.

20. A method according to claim 19 wherein sensing pressure in photoacoustic waves comprises sensing pressure from photoacoustic waves stimulated substantially at the interface between the target region and the first layer.

21. A method according to claim 20 wherein sensing pressure comprises sensing pressure from photoacoustic waves stimulated substantially at the interface between the first and second layers.

22. A method according to claim 21 wherein dependence on ratios comprises dependence on a ratio between pressure of photoacoustic waves stimulated by light at the first wavelength and pressure of photoacoustic waves stimulated by light at the second wavelength substantially at a same interface.

23. A method according to claim 22 wherein dependence on pressures comprises dependence on a ratio between pressure of photoacoustic waves stimulated by light at the first wavelength at one of the first and second interfaces and pressure of photoacoustic waves stimulated by light at the second wavelength in a different one of the interfaces.

24. A method according to any of claims 19-23 and comprising acquiring a value for the at least one optoacoustic property responsive to a calibration procedure comprising:

acquiring at least one assay of the analyte without using the function; and

determining a value for the known property by requiring that for each assay acquired by the different method an assay determined in accordance with the function be substantially equal to the acquired assay.

25. A method according to any of claims 13-24 wherein the at least one optoacoustic property comprises a ratio between the absorption coefficients for light in the implant at the first and second wavelengths.

26. A method according to claim 3 wherein the implant comprises three layers, a first layer contiguous with the target region and a second layer contiguous with a third layer.

27. A method according to claim 26 wherein the first layer has a thickness substantially less than a diffusion length for heat in the material from which the first layer is formed.

28. A method according to claim 27 wherein the photoacoustic coefficient of the first layer is substantially less than the photoacoustic coefficient of the target region and of the second layer.

29. A method according to claim 28 wherein the first layer absorbs a major portion of light incident on the layer at the second wavelength.

30. A method according to claim 29 wherein the portion is greater than about 70%.

31. A method according to claim 29 wherein the portion is greater than about 80%.

32. A method according to claim 29 wherein the portion is greater than about 90%.

33. A method according to claim 29 wherein the first layer is substantially transparent to light at the first wavelength.

34. A method according to claim 33 wherein the second layer is substantially transparent to light at both the first and second wavelengths.

35. A method according to claim 34 wherein the third layer absorbs light at both the first and second wavelengths.

36. A method according to claim 35 wherein reflectance for light at the first and second wavelengths at the interface between the second and third layers is substantially the same.

37 A method according to claim 36 wherein choosing the wavelengths comprises choosing the wavelength sufficiently close to each other so that the reflectance is substantially the same.

38. A method according to any of claims 26-37 wherein using the sensed pressure comprises determining a concentration of the analyte in accordance with a function dependent on the known property and having dependence on the pressures only through ratios of the pressures.

39. A method according to any of claims 26-38 wherein sensing pressure in photoacoustic waves comprises sensing pressure from photoacoustic waves stimulated substantially at the

interface between the target region and the first layer and at least one interface between the layers.

40. A method according to any of claims 26-39 wherein sensing pressure from photoacoustic waves stimulated substantially at the interface between at least one interface between the layers comprises sensing pressure from photoacoustic waves stimulated substantially at the interface between the second and third layers.

41. A method according to claim 40 wherein dependence on ratios comprises dependence on a ratio between pressure of photoacoustic waves stimulated by light at the first wavelength and pressure of photoacoustic waves stimulated by light at the second wavelength substantially at a same at least one interface.

42. A method according to claim 41 wherein the at least one interface comprises the interface between the target region and the first layer.

43. A method according to claim 41 or claim 42 wherein the at least one interface comprises the interface between the second and third layers.

44. A method according to claim 43 wherein the function is dependent upon a ratio between the absorption coefficient for light at the first and second wavelengths in the third layer.

45. A method according to any of claims 26-44 wherein the function is dependent upon a ratio between intensity of light at the second wavelength in the first layer and near to the interface between the first layer and the target region and intensity of light at the second wavelength in the second layer near to the interface between the first and second layers.

46. A method according to claim 26-45 wherein dependence on pressures comprises dependence on a ratio between pressure of photoacoustic waves stimulated by light at the first wavelength at one of the interface between the target region and the first layer and the interface between the second and third layers and pressure of photoacoustic waves stimulated by light at the second wavelength in the other of the interfaces.

47. A method according to any of claims 38-46 and comprising acquiring a value for the at least one optoacoustic property responsive to a calibration procedure comprising:

acquiring at least one assay of the analyte without using the function; and

determining a value for the known property by requiring that for each assay acquired by the different method an assay determined in accordance with the function be substantially equal to the acquired assay.

48. A method according to any of claims 13-47 wherein the at least one optoacoustic property comprises a ratio between the absorption coefficients for light in the implant at the first and second wavelengths.

49. A method according to any of claims 4-48 wherein the function is dependent on a parameter that is a function of concentrations of analytes in the target region other than the target analyte, and comprising determining a value for the parameter, which value is used in the function for determining concentrations of the target analyte at least twice during a period of time for which the parameter is considered to be constant.

50. A method according to claim 49 wherein the time period is less than or equal to about an hour.

51. A method according to claim 49 wherein the time period is less than or equal to about 8 hours.

52. A method according to claim 49 wherein the time period is less than or equal to about 24 hours.

53. A method according to any of the preceding claims and comprising choosing the second wavelength so that absorption and scattering of light in the target region is a function substantially only of a concentration of a single particular analyte in the target region and an absorption and/or a scattering cross section of the particular analyte.

54. A method according to claim 53 wherein the extinction coefficient for light in the target region at the second wavelength is a function substantially only of the concentration and absorption cross section of the particular analyte.

55. A method according to claim 53 or claim 54 wherein for the second wavelength a ratio between the absorption and scattering cross sections in the target region is known.

56. A method according to any of claims 53-55 wherein the particular analyte is water.

57. A method according to any of the preceding claims wherein the body is a living body.

58. A method according to any of the preceding claims wherein the analyte is glucose.

59. A method of assaying an analyte in a body part comprising:

illuminating the body part with at least one pulse of light that is absorbed and/or scattered by the analyte and stimulates photoacoustic waves in a first, target, region and a second, reference, region of the body part, wherein the reference region interfaces with the target region and has at least one known optoacoustic property;

sensing pressure in the photoacoustic waves from the target and reference regions stimulated by the light; and

using the sensed pressures and the at least one known optoacoustic property to assay the analyte in the target region

60. A method according to claim 1 wherein the reference region is a natural region of the body part.

61. A method according to claim 1 wherein the reference region is an artificial implant located in the body part.